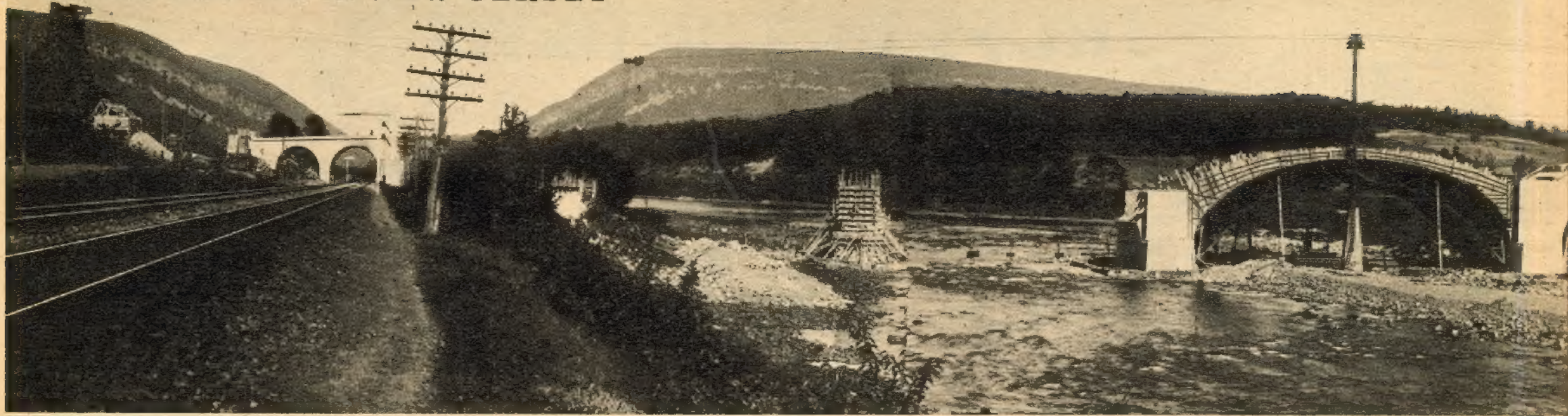




Conquering the Terrain

(New Jersey probably had a more important role in the establishment and development of railroads than any other state in the country. This article, the eleventh of a series, deals with some of the engineering feats undertaken by Jersey railroads to reduce travel time and operating costs.)

"**A**H, those American railroad builders! They come to a great river; they go under it. They come to a mountain; they go through it. They want to get from place to place; they build straight!"

Engineers throughout the world looked on in awed admiration as American railroads in 1900 faced up to the hard fact that the time had come to pour millions of dollars into the fight for passenger and freight traffic.

No matter when or where the gaze of foreign engineers strayed, their attention always came back to New Jersey. Back in the 1850s they had given respectful attention to the long tunnels John I. Blair had carved under Scott's Mountain in Warren County. At the same time they were impressed by the tunnel the Erie Railroad cut through Bergen Hill just west of Jersey City.

Yes, when the mountains got in the way the railroads went through them...

THE Lehigh Valley burrowed through Musconetcong Mountain and the Lackawanna pierced Bergen Hill west of Hoboken in the 1870s. Less than a decade later the engineers were taking another whack at Bergen Hill, this time at Weehawken, where the upstart New York, West Shore & Buffalo Railway Co. was getting ready to challenge the mighty New York Central.

The West Shore got close scrutiny, because that first direct challenge to the mighty New York Central provided the key to much of the feverish engineering work between 1900 and 1910.

If some way wasn't found to battle the Central, there weren't going to be many crumbs for the other railroads to pick up from the

Engineering World Marvels at Ability of Jersey Railroads to Build in a Straight Line by Leveling Mountains and Tunneling Through Rock and Riverbed

BY JOHN T. CUNNINGHAM

rapidly expanding Western trade.

The Central had a station near its present location in New York, which was considered "a bit far out of the city to be practical." Central could advertise:

"Chicago to New York—DIRECT!"

OTHER railroads through New Jersey were worried. All of them terminated in Hoboken or Jersey City and no matter how rail magnates glossed over the fact, passengers could see for themselves that the Hudson River was between them and New York.

It was bad enough on clear mornings, but when fog reduced the Hudson River to an eerily dangerous travelway there were lots of Western men aboard ferryboats who made up their minds to go back to Chicago and tell the folks to ride the New York Central.

Thus, every railroad stockholder in New Jersey cheered (inwardly, of course, in these polite 80s) when the West

Shore knocked the chip off Central's shoulder.

Through the flinty rock of Bergen Hill at Weehawken the West Shore sliced its 4,225-foot tunnel in 1881. It cut over the north portion of the Meadows and sped through pleasant Bergen County terrain to Orangeburgh, N. Y.

Then the trouble started.

THE mountains at Weehawken? Through it men! The mountain at West Point? Through it men—directly under the parade ground of the U. S. Military Academy!

Up the stony cliffside on the west bank of the Hudson the West Shore fought its way. Ropes draped over the cliffs held men in place while they cut starting points for construction. More than 20,000 workmen fought the terrain at one time.

Late in 1883 West Shore trains rolled into Buffalo via a conglomeration of amalgamated short lines. The stockholders set out to get some of their \$50,000,000 back.

Down came Central's rates. West Shore met the slash. Fares between Buffalo and New York dropped to a cent a mile. For \$2 a man could buy a round trip ticket between Syracuse and New York.

Everybody loved the battle but the railroads.

CENTRAL lost many more millions than the West Shore, but there was a vital difference—West Shore lost money it never had in the first place. Such matters led only to bankruptcy. On June 9, 1884, receivers were appointed and a year later West Shore passed into the control of the New York Central.

Now the lines terminating in Hoboken and Jersey City faced the fact that they were at a greater disadvantage than before. Something had to be done about that Hudson River.

Something, for example, like the tunnel that D. C. Haskins tried to dig...

Haskins picked up some slim capital in the mid-1870s

and began a tunnel under the river to link Jersey City with Washington Square in New York.

DANGER lurked in every foot of the tunnel. Men entered air locks to cut at the soft soil. Pneumatic pressure was supposed to hold back the earth, but the mud was too soft to hold the air. Finally, on July 21, 1880, the tunnel gave way and 20 men were killed.

Newspaper readers read of the tragedy with horror and shed many a tear for heroic Pete Woodland, who died under the merciless Hudson.

Pete saw the first tiny leak in the earth. He shouted to the men and raced to the airlock. Eight men rushed out as Woodland held open the door. Suddenly the tiny leak gave way to a gush of water, endangering those in the airlock as well as those in the tunnel.

Woodland, who could have been the first out, instead slammed the door shut. Eight living men inside the airlock heard the river waters roar down on Pete and 19 fellow workers.

HASKINS failed financially in 1882, after he had built 1,800 feet of tunnel. The company was reorganized in 1890, built the tunnel another 1,800 feet, and went into bankruptcy again.

No, men, there's no way to tunnel the Hudson...

George B. Roberts, president of the Pennsylvania, set out to solve the problem in other ways. First he encouraged Gustave Lindenthal, eminent engineer, in his 1884 plan for a high level bridge over the Hudson.

Nothing doing, said the War Department—not with those piers in the harbor.

Lindenthal was back in 1890 with plans for a greater bridge over the river at 59th street, plus an Act of Congress permitting its building. This was a bridge to excite wonder. It was to have three decks, carrying 14 tracks and roadways over an arch 3,000 feet long! Its cost of \$100,000,000 was unprecedented.



One of suspension bridges used for Lackawanna Cut-Off near Blairstown, 1909.



The Delaware Water Gap leg of Lackawanna's Cut-Off is shown in this panorama from Pennsylvania side of the river. In process of construction are five of the main spans of the 1,450-foot-long bridge across the Delaware which was built along the lines of the Paulins Kill viaduct at Hainesburg. The 28-mile Cut-Off project, completed in 1911 after three years work, cost \$10,000,000. It shortened Lackawanna route by 11 miles, eliminated grade crossings and speeded up running time. "Gap" appears as break in mountain range at far left.

THE Pennsylvania couldn't swing the \$100,000,000 alone, asked the other railroads to co-operate.

"What," said the other railroads, "Spend that kind of money? Let 'em ride ferries!"

Besides, 59th street was far above where the city would ever spread.

The Pennsylvania discussed other alternatives. Leave the main line at Rahway, cross Staten Island and tunnel under the Narrows to Brooklyn, bypassing Newark. Tunnel under the Hudson from Jersey City to Maiden lane in New York. Carry passenger cars on barges.

There didn't seem to be any answer.

MEANWHILE, in 1900, along came William Gibbs McAdoo to grasp "that dead thing, laid away in the cemetery of unworkable ideas"—the tunnel started by Haskins in 1879.

A young struggling lawyer, McAdoo's enthusiasm prompted others to lend capital up to \$4,000,000. Under the river in 1902 again went workmen to ram the tunnel through the 2,000 yards needed to complete it. Construction moved ahead 24 feet a day in finishing the

first tunnel. Later, when a second tunnel was begun, the speed was advanced to 72 feet every day.

The first of the tunnels from Hoboken to Sixth avenue and 19th street was finished February 25, 1908. President Theodore Roosevelt was on hand to push the button which got Hudson & Manhattan Railroad service underway.

The H. & M. lines were extended to Jersey City and in November, 1911, the tubes reached Newark — inviting the commuter to a quick no-change trip to the city.

Alexander Johnston Cassatt, Pennsylvania Railroad president from 1899 to 1906, encouraged by McAdoo's H. & M. operation, also decided in 1902 that the time had come to carry the Pennsy's tracks straight into the heart of the city through a Hudson River tunnel.

THE Pennsylvania project actually started just east of Newark, where a new double-track line crossed the Meadows on a high hill, dove under Bergen Hill to New York City and then continued under the East River to connect with the Pennsylvania-owned Long Island Railroad.

It was a plan with great vision, and its successful com-

pletion in 1910 gave the Pennsylvania a hold on long-haul passenger traffic which no other Jersey railroad could match — unless, of course, it also crossed over or under the Hudson to deposit its passengers in the heart of the city without change.

Behind in the race for through-passenger traffic, other New Jersey railroads set about getting their lines in shape to fight for the lucrative freight traffic. They filled here, straightened out



The Haskins tunnel.

curves there. They eliminated grade crossings, they revitalized their roadbeds.

But none of them matched the Lackawanna's noble Jersey Cut-Off from Lake Hopatcong to Delaware Water Gap.

STARTED in August, 1908, and finished in December, 1911, the 28-mile Cut-Off is one of the all-time great engineering feats. Every mile of the tremendous undertaking was carefully studied by engineers and diplomats from all over the world. Magazine and newspaper writers correctly unleashed their superlatives — "greatest," "biggest," "longest" in the world.

There had never been anything like the Cut-Off.

The Lackawanna had long known something had to be done about the line from Port Morris to Washington. In that stretch a train swung around 57 curves, some of them extremely sharp. Grades were steep; it was expensive to haul heavy coal

(Continued on Following Page)



The Hainesburg viaduct was a "monolithic mass."

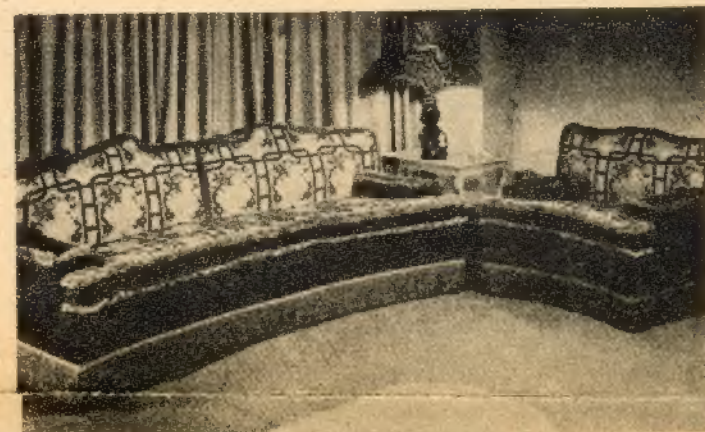


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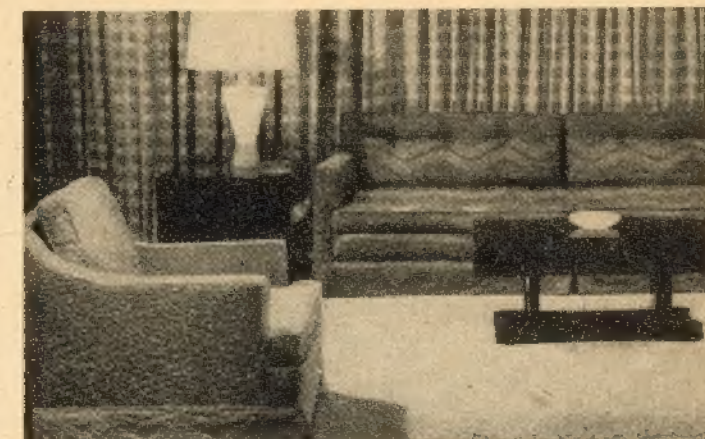
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JERSEY RAILROADS---Tunnels and Cut-Offs



Bergen Hill entrance of Pennsylvania Railroad, leading to midtown New York,
at time of completion in 1910. BELOW: Join-up of tunnel under Hudson in 1909.

(Cont'd from Preceding Page)
cars over them. The route
was long—40 miles from
Delaware Water Gap to Port
Morris.

It was going to cost mil-
lions of dollars anyway, why
not do it in the grand man-
ner, Lackawanna President
Truesdale argued? Why not
cut straight across country?

Do it, said the Lackawanna
directors. Build the Cut-Off.

THREE years and \$10,000,-
000 later the Lackawanna
took a corps of reporters and
officials over the line. All
were handed the statistics!

"Length: 28.45 miles . . . 20
minutes saved for passenger
trains and one hour for
freight trains . . . 57 cents
saved per train mile . . . 15

curves versus 57 on the old
line . . . maximum grade less
than half . . . tunnel length
1,000 feet as against 3,971 on
the old line . . . 6,000,000
pounds of dynamite, 6,625,000
cubic yards of fill, 4,500,000
cubic yards of earth borrowed
from surrounding farms!"

The story unfolded as the
first inspection train swung
onto the Cut-Off a quarter-
mile west of Hopatcong Sta-
tion, northwest on the long
western slope of the Walkill
Mountains and across Lubber
Run Valley on an embank-
ment containing 1,100,000
cubic yards of fill.

"Interesting thing about
this whole job," a Lacka-
wanna official told the in-
specting group. "We built
the Cut-Off in seven sections,
something radically new. We
gave seven separate con-
tracts. Some figured there
would be trouble, but things
couldn't have been more
pleasant. Never a hitch.
Never a minute's trouble."

AT Andover the Cut-Off
curved westward in a long
gentle sweep and headed in
an almost straight line for
the Gap. High up over the
beautiful West Jersey farm-
land rode the Lackawanna in-
spection special. All along
the route farmers stopped
their wagons on intersecting
roads to wave—and to point
up the fact that the Cut-Off
rode over countless archways
built to eliminate grade-
crossings.

Every one on the train
waited for a view of the tre-



mendous Pequest Valley fill
—unprecedented in massive-
ness for a single piece of
work at a given point.

Fully three miles long, and
rising from 75 to 110 feet

over the floor of the valley,
the Pequest fill contained
6,625,650 cubic yards of fill—
then the largest railway fill
ever completed.

There was little doubt
where the fill had come from.
From any window it was easy
to spot one of the "borrow
pits" on the scattered 750
acres of farmland bought for
fill. Dozens of little man-
made lakes showed where the
fill-takers had cut down be-
low water level, as much as
20 feet from the surface.

"Wait until we get to
Hainesburg," the Lacka-
wanna guide promised. "We'll
really show you something!"
His promise was kept.

REPORTERS, officials and
engineers alike gasped at the
magnificence of the long,
graceful viaduct spanning the
Lehigh & New England Rail-
road, the Paulins Kill River
and the broad valley on either
side.

There was a "greatest"
story in the Hainesburg via-
duct, too—it set a new
world's record for the use of
concrete in a single struc-
ture. It was 1,100 feet long
and 115 feet high, "a single
monolithic mass."

Down in the villages beside
the Cut-Off the people along
the way had stories of their
own to add to the statistics
and the visible wonders.

The true story of how a
mountain top was literally
blown off was the best. The
contractor tunneled through
the rocky summit and put

32,500 pounds of dynamite
and Judson powder within.
The entrance was hermeti-
cally sealed after a wire had
been carried a half-mile away
to an electric battery.

GUARDS cleared the coun-
tryside of man and beast. A
spark shot through the wires.
Farmers watching from
woodlands two miles away
declared the whole mountain
disintegrated. Minutes later
the settling dust revealed the
mountain had disappeared
into eternity.

Men and boys for miles
around never tired of sneak-
ing off from the fields to
watch the spectacle of the
"moving bridge" at Andover.
To move fill where it was
needed, the railroad built a
suspension bridge out from a
mountainside, ran cars to the
edge and dropped the fill. As
the mounds of fill moved
along, the suspension track
also moved.

"Beats all," the boys told
one another, "like a durned
train running in thin air!"

Equally intriguing were
temporary trestles built 40
feet high to carry fill over
valleys in other places. The
construction crews filled in
the trestle, then built another
40-foot trestle on top of the
fill and filled that in, too.

The Cut-Off ignored all in
its path; even a few houses
and barns disappeared under
the fill.

AT Huntsville boys and
girls had a temporary thrill.
The Cut-Off was going to
cover the school! Mounds of
earth moved up to the very
edge of the school in the
Spring. The earth-movers
went elsewhere until June
graduation.

Then Huntsville literally
buried its school.

Boys clambered on the
school to tie a black crepe
around their unlamented old
building. A few mock words
of mourning were said. Down
tumbled the dirt from the
Cut-Off above. In a few
hours the school was de-
cently buried.

The schoolboys cheered
mightily, then looked sadly
across the street. The rail-
road was building a new
Huntsville School—for Sep-
tember occupancy.

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